

## Association for Information Systems AIS Electronic Library (AISeL)

---

AMCIS 1998 Proceedings

Americas Conference on Information Systems  
(AMCIS)

---

December 1998

# IT-Enabled Knowledge-Intensive Business

Apiwan Dejnaronk

*Southern Illinois University at Carbondale*

Follow this and additional works at: <http://aisel.aisnet.org/amcis1998>

---

### Recommended Citation

Dejnaronk, Apiwan, "IT-Enabled Knowledge-Intensive Business" (1998). *AMCIS 1998 Proceedings*. 193.  
<http://aisel.aisnet.org/amcis1998/193>

This material is brought to you by the Americas Conference on Information Systems (AMCIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in AMCIS 1998 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# **IT-Enabled Knowledge-Intensive Business**

**Apiwan Dejnaronk**

Department of Management  
Southern Illinois University at Carbondale

## **Introduction**

The impact of Information Technology (IT) on business has been debated for over many years. It is believed that IT influences organizational change and transforms firms into knowledge providers who offer smart products or services (Davis & Botkin, 1994). The organizational transformation requires the shift in economic activities from information processing to knowledge processing. Although business IT value and its impact on firm's knowledge are recognized, little effort has been made to study the relationship between the two.

Knowledge is an impetus of the economic growth and the shift to knowledge-based environment (Paye, 1996; Stevens, 1996). Managers today are facing two challenges: 1) the value of IT in knowledge creation, utilization, retention and maintenance (De Jarnett, 1996), and 2) the importance of managing firm's knowledge (Raghuram, 1996). To prepare for those challenges, this paper attempts to answer three questions: 1) what is knowledge-intensive business, 2) does IT lead to knowledge-intensive business, and 3) what factors account for variations in the amount of knowledge accumulated?

## **IT and Organizational Knowledge**

Two trend emerged during the 1980s are: 1) the increasing use of IT and its impact on organizations, and 2) the evolution of knowledge-based economy (Lehman, 1996). Recently, researchers have found that the value of IT is added to firm's productivity and customer benefit (Hitt & Brynjolfsson, 1996) but not business profitability (Kemerer & Sosa, 1991). Andersen (1995) argues that the relationship between IT and organizational learning exists. Since knowledge is something that is acquired and accumulated through the process of learning (Yate & Benjamin, 1991), it is believed that IT may contribute to organizational knowledge. In this paper, knowledge is defined as processed information that enables receivers to learn.

## **Knowledge-Intensive Business**

Knowledge-intensive business refers to a company that is able to collect (data), interpret (information), and learn from the utilization of knowledge (adapted from Daft & Weick, 1984), providing customers with smart product and service (Davis & Botkin, 1994). The current economy is in the stage of "technology-driven" in which corporations must have access to two key resources: knowledge and people (Due, 1995). It is predicted that ninety seven percent of total employment increased during the past seven years is caused by an emergence of "knowledge-intensive industries." (Glen, 1992) In this study, organizational knowledge is measured in terms of its knowledge intensiveness or the extent to which a firm acquires and accumulates knowledge through knowledge employees who are able to transform information available into knowledge that enables them and the organization to learn and to improve performance. According to Beck (1992), the degree of firm's knowledge intensiveness can be ranked into three groups: 1) high (40 percent or more), 2) medium (20-40 percent), and 3) low (less than 20 percent).

## **Theoretical Perspectives**

The question addressed here is why the increasing use of IT may affect the amount of knowledge possessed by a firm. The use of IT reduces both coordination and production costs (Malone et al., 1987).

First, coordination costs or transaction costs are composed of both internal and external costs (Brynjolfsson et al., 1994). IT reduces the internal cost within a group of individuals or business units, or between both groups by facilitating the flow of information within an organization. IT also reduces the external cost between a firm and its customers and/or suppliers. By reducing the coordination costs, IT enables an availability and accessibility of collective firm's knowledge (Yate & Benjamin, 1991).

Second, production costs are costs of producing and distributing a product or service (Malone et al., 1987). IT can lower the costs of production by improving the production process (Brynjolfsson et al., 1994). The rapidly decrease production costs leads to mass market, and affects learning curve (Yate & Benjamin, 1987). Since the effect of learning curve involves the transformation of firm's experiences into knowledge (Huber, 1996), the falling production costs enabled by IT may lead to increase in the amount of knowledge created from learning experience.

Another area that has been examined is outsourcing. It is found the outsourcing efforts are not always successful. Several disadvantages associated with outsourcing IT services (e.g., lack of knowledge workers, decrease opportunities for an organization to learn, etc.) are detrimental to organizational knowledge (Earl, 1996). Particularly in the situation where the value of information is critical, outsourcing seems to be an inappropriate strategic choice (Garrett, 1994). This implies that investment

in outsourcing IT-related activities may deplete stored knowledge in an organization, or at least prevent the knowledge to accumulate.

In summary, the relationship between IT investment and organizational knowledge, if exists, is complicate. IT Spending may lead to opportunities (e.g., cost reduction, customize intelligent products) or threats (e.g., risks associated with outsourcing). At the point, the findings still vary across existing studies.

## Hypotheses and Model

In this section, we conceptualize the economic impact of IT on the degree of business knowledge intensiveness. The purpose here is to quantify the relationship between IT investment and organizational knowledge by developing an econometric model for testing the following hypotheses.

### *The Relationship Between IT Investment and Organizational Knowledge*

Beck (1992) invents a set of measures to assess the amount of organizational knowledge in a technology-driven environment. Using the number of knowledge employees as the surrogate measure of firm or industry knowledge-intensiveness, she develops two scales: *Knowledge ratio*, and *Return-on-Knowledge (ROK)*. The former or so called *Corporate IQ* refers to the number of knowledge employees as a percentage of total employment per firm or industry. The latter is the ratio of the number of knowledge employees to profits earned. *ROK* is similar to Return-on-Asset (ROA) in the way that they indicates how effectively the firm or industry exploits its assets or knowledge employees respectively (Parker, 1996). From these two scales, one may expect that heavily IT-invested firms are highly knowledge intensive and able to use their knowledge assets productively.

**H1:** *The contributions of IT investment to organizational knowledge are not zero and positive*

The second hypothesis is derived from the idea that benefits obtained from different types of IT investment are unequal. Parker (1996) points out that IT investment is divided into two portions: replacement expenses (e.g., a substitution of email and voice mail for a switchboard) and sophisticated innovative technology expenses (e.g., group technology). To understand the patterns of IT spending, the two portions must be compared. Therefore,

**H2:** *The contributions of IT investment in innovative processes to organizational knowledge are significantly higher than those in replacement processes.*

### *The Control Variables*

Not only IT but also other factors such as expenses on R&D activities, quality improvement projects, and professional training programs affect the amount of organizational knowledge accumulated over time. First, Lehman (1996) proposes that R&D spending helps stimulate the economic growth and the shift to knowledge-based economy. Second, Dr. Deming an expert in quality management has established a principle called "a system of profound knowledge" which focuses on the necessity to retain firm's knowledge (Evans & Lindsay, 1996). This means that spending on quality management projects may contribute to organizational knowledge. Third, training expenses are budgeted for teaching people how to do a professional job. Companies investing in professional training expect their employees to do things better, and hence contribute to organizational learning. Finally, two dummy variables: Industry and Year will be added to control for the variations in industry and time respectively.

### *The Model*

To develop a model for studying the relationship between IT investment and organizational knowledge, we assume that Business Knowledge Intensiveness (K) is accumulated through a function of IT expenses on both Replacement Processes (R) and Sophisticated Innovative Processes (S), and Non-IT Expenses (NIT). To generalize the result, we consider the investment dollars of each firm (i) in each year (t) given the data is collected over a certain period of time. Therefore, the function F is

$$K = F(R, S, NIT; i, t) \quad [1]$$

As mentioned earlier, two measures of knowledge intensiveness are *Knowledge ratio* and *Return-on-Knowledge:ROK* (Beck, 1992). The *Knowledge ratio* indicates the current level of knowledge industrywide or firmwide. The *ROK* focuses on whether an industry or firm utilizes its knowledge people effectively and sufficiently to be able to contribute significantly to business profitability (Parker, 1996).

## Potential Data and Methodology

An appropriate data set for the model is data collected from firms across industries over a certain period of time. The data set must contain the total capital investment and the amount of dollars spent on IT. Additional information is needed to divide IT expenses into the dollars spent on replacement technology or sophisticated innovative technology. Moreover, researchers need to obtain data on other expenses such as spending on R&D, quality management projects, and professional training programs. Variables and their operationalized measures are described in Table 1.

To estimate the parameters in [1], the function F must assume some functional pattern. Unfortunately, no prior work provides a clue about what kind of pattern is appropriate here. We simply assign a linear function to those parameters. It is realized that

**Table 1. Variables and Measures**

Variable	Description	Measure
Dependent	Knowledge Intensiveness	<i>Knowledge ratio</i> : the number of knowledge employees divided by the total employment in an industry <sup>1</sup> <i>Return-on-Knowledge assets</i> : the number of knowledge workers to profit earned <sup>1</sup>
Independent	IT Investment	<i>Replacement Processes Expenses</i> : the amount of current IT spending in replacement processes, e.g. installing email and voice mail to replace an old switchboard <sup>2</sup> <i>New technology expenses</i> : the amount of investment in innovative and sophisticated new processes, e.g., group technology <sup>2</sup>
Control	Non-IT Investment R&D Expenses Quality Mgmt. Expenses Training Expenses	Total capital spending minus IT spending The amount of dollars spent on Research & Development The amount of dollars spent on quality management projects The amount of dollars spent on training programs excluding IT-related training

<sup>1</sup> Beck (1992), <sup>2</sup> Parker (1996)

without the theory support, the results may be dubious. However, this study is an early effort to conceptualize the complex link between IT and firm's knowledge. We intend to provide a basic understanding and guidance for the future researchers who are interested in the impact of IT on firm's knowledge.

We develop a linear model to measure the relationship between IT investment and the degree of knowledge intensiveness for a given firm in a given year. Three control variables are R&D expenses, quality management expenses, professional training expenses, industry, and year. The multiple regression model is shown in table 2.

**Table 2. Multiple Regression Model**

$K_{it} = \beta_0 + \beta_1 R_{it} + \beta_2 S_{it} + \beta_3 NIT_{it} + \beta_4 RD_{it} + \beta_5 QM_{it} + \beta_6 PT_{it} + \beta_7 INDUSTRY_{it} + \beta_8 YEAR_{it} + \varepsilon$ <p> <math>K_{it}</math> = The degree of knowledge intensiveness of firm i in year t  <math>R_{it}</math> = IT expenses per employee on replacement technology of firm i in year t  <math>S_{it}</math> = IT expenses per employee on sophisticated new technology of firm i in year t  <math>NIT_{it}</math> = Non-IT expenses per employee of firm i in year t  <math>RD_{it}</math> = R&amp; D expenses per employee of firm i in year t  <math>QM_{it}</math> = Quality management expenses per employee of firm i in year t  <math>PT_{it}</math> = Professional training (excluding IT-related training) expenses per employee of firm i in year t  <math>INDUSTRY_{it}</math> = A dummy variable for each industry  <math>YEAR_{it}</math> = A dummy variable for year ; <math>\varepsilon</math> = An error term </p>	[2]
--	-----

Given the set of cross sectional and time series data mentioned earlier, two different techniques appropriate for data analysis are ordinary least squares (OLS) regression and a two stage least-squares (2SLS) regression. Suppose the size of each firm in the sample varies significantly, we may encounter a problem of heteroskedasticity or inconstant error variance. To correct this problem, we divide all independent variables by the number of employees within each firm.

## Conclusion

This study serves as an initial step in analyzing the complex relationship between IT investment and organizational knowledge. The literature review examines the impact of IT on the degree of knowledge intensiveness possessed by firms. Based on the existing theoretical perspectives, we hypothesize that the use of IT is positively correlated with business knowledge intensiveness. Consequently, we develop a linear regression model for analyzing this hypothesis. Three research questions asked earlier have been answered in this study. However, more research still needs to be done in this area. Although we currently do not have the real data to test our model, we hope that our findings will motivate future researchers to further investigate the relationship between IT investment and organizational knowledge.

## References

Reference available upon request (apiwan@siu.edu).